

Appendix A: Review of Economics in Influential Delta Studies (Part One)

There have been many studies, plans, and reports about the Delta in the past two decades. The majority of these studies have been focused on scientific rather than economic aspects of Delta issues. The relative lack of economic research is somewhat surprising given that the statewide concerns regarding the future of the Delta are as much about economics as environmental concerns.

The most influential economic analysis to date has been contained within large, comprehensive reports that were not primarily focused on economics. These include a series of reports published by the Public Policy Institute of California (PPIC) and the Delta Risk Management Study (DRMS). These reports do provide a significant amount of valuable background information and are initial attempts to investigate the complex economic issues in the Delta. Like many initial attempts to study a question, the economic research in these reports has shortcomings, and is insufficient to support the strong conclusions that have been made. In particular, the PPIC reports have advocated for the construction of a peripheral canal around the Delta on economic criteria, and the DRMS study contained widely quoted estimates of economic costs associated with the failure of Delta levees. These two reports have provided the primary economic justification for building large, isolated water conveyance facilities around the Delta.

Because of the influence of these studies on Delta planning efforts, the Delta Protection Commission requested an independent review of the economic analysis in key reports. Of particular interest is the PPIC Comparing Futures Report (2008) that recommended a peripheral canal, and the Delta Risk Management Strategy Phase 1 Report (2009). In addition, some economic aspects of other PPIC reports are worth mentioning. Finally, the DPC also requested a review of the levee decisions study by Suddeth, Mount, and Lund (2010) that was originally published as an Appendix to the 2008 PPIC Comparing Futures study. The levee decisions study claims that it is not economically efficient to upgrade most Delta levees and repair levee breaches and that large numbers of Delta islands should be permanently flooded over time.

The following is a summary of significant concerns identified with these studies' economic data, analysis, and conclusions.

1 PPIC Comparing Futures Report (2008)¹

- Errors and limitations in the analytical framework favor the option of a peripheral canal.
 1. Does not utilize the conventional, present discounted value approach to evaluating investments. In particular, their unconventional approach ignores the financially significant 10-25 year time to build a canal when costs are incurred without benefits.
 2. Only evaluates benefits in a single distant year when benefits are at a peak due to an assumed 100% loss in ability to export water from south Delta. Even if one accepts the assumption that water exports are eventually cut by 100%, a conventional

¹ <http://www.ppic.org/main/publication.asp?i=810>

present discounted value approach would properly account for the fact that the benefits of a canal would start small and grow over time.

3. Market values for fishery improvements are ignored.

4. Non-market values for fisheries and environmental improvement are also ignored because these techniques are “too controversial”.

5. Because the framework does not place an economic value on fisheries/environment, their analytical framework is limited in its ability to recommend any policy. It can only recommend a choice that is best on both environmental/fishery and economic/water supply criteria. Although their analysis did not find a strategy that was best on both criteria, the authors presented their endorsement of a peripheral canal as a scientific conclusion rather than a subjective opinion about the relative value of environmental improvement. As discussed above and below, it is also very important to note that the conclusion that the peripheral canal is the best economic strategy is highly questionable due to the approach and data employed.

- Various assumptions exaggerate costs of reduced water exports, especially to urban users, and therefore favor a peripheral canal over reducing water exports. (See Appendix H of Comparing Futures for most of these assumptions).

1. Overestimated urban water scarcity by using an extremely high projection of population growth of 65 million in 2050, and justifying it with a reference to Department of Finance projections which were actually less than 60 million, not 65 million. They later revealed that their source was Landis and Reilly (2003)², a study that assumed the 2000 population was nearly 1 million higher than the 2000 Census and was based on DOF projections from the 1990s. DOF projections are notoriously high, and virtually all Census based forecasts at the time put the California population at 55 million in 2050, and updated projections based on the 2010 Census now estimate population below 55 million in 2050. Assuming over 10 million additional urban water customers than are likely to exist has significant impacts on the cost of reducing Delta water exports.

2. Overestimates cost of water recycling as an urban alternative. Their calculations assumed recycled wastewater would cost urban areas \$1,480 per acre foot (2008\$), even though other PPIC reports from the same time period cited costs of \$600/af, and a range of \$300-\$1300/af around the same time.³ Rather than using current cost estimates to calibrate their model, the authors utilized outdated cost estimates from the 1990s, and inflated them to 2008 dollars using an unrelated construction cost index.

3. Although less significant than the water recycling overestimate, Comparing Futures also overestimates cost of desalination as an urban alternative. Their calculations assumed desalinated water would cost urban areas \$2,072 per acre foot (2008\$), even though other PPIC reports from the same time period cited cost range of \$500-900/af for brackish desalination and \$900-2500/af for seawater desalination. Rather than using current cost estimates to calibrate their model, the authors utilized outdated cost estimates from the 1990s, and inflated them to 2008 dollars using an unrelated construction cost index.

4. Since they are modeling 2050 costs, the high cost assumptions for water recycling and desalination are an implicit assumption that technology goes backwards over the next 40 years, despite recent and expected future cost savings in both technologies from new research and development.

²Landis and Reilly (2003), “How will we grow?” <http://escholarship.org/uc/item/8ff3q0ns#page-27>

³ See PPIC reports, California Water Myths (2009) and Water for Growth (2005).

5. Urban water scarcity costs are also exaggerated by ignoring conservation which many believe is the least costly source of urban water supply. They use old estimates of urban water demand without making any allowance for gains already made in reducing urban demand with new technologies or accounting for expected new conservation.

6. For agriculture, they exaggerate the costs of water scarcity on San Joaquin Valley agriculture using the same models that incorrectly projected 90,000 lost jobs from the 2009 drought. Based on the 2009 drought episode, their costs of agricultural water scarcity are a minimum of three times and more likely six times too high.

7. Simple calculations show results are highly sensitive to just a few of these assumptions, and that their results are unlikely to hold under more realistic assumptions.⁴

- Other Issues

1. The current costs of isolated conveyance are much higher than they assumed for a peripheral canal, although the authors can't be blamed for changing cost estimates.

2. Authors have not demonstrated the results are robust to alternative, more realistic data assumptions.

2 Delta Risk Management Strategy (DRMS) Phase 1⁵

- Phase I study was sharply criticized, and independent reviewers warned that results only indicated directions of risks and numerical predictions should not be taken literally.

- Economic loss calculations in the report critically depend on the failure probabilities in DRMS that are considered too high by virtually all experts.

- In-Delta flood loss costs are exaggerated. Some examples:

1. Overly high flood risk is matched with high-value properties. For example, the Sargent-Barnhart tract in the Stockton Brookside neighborhood was developed in the late 1980s with over 200 year flood protection from modern levees as recently confirmed by DWR FloodSafe program maps. However, DRMS estimates the island has over 7% probability of flooding, 3rd highest of all Delta islands. It is obvious that DRMS is not incorporating substantial levee upgrades that occurred twenty years prior to the analysis. DRMS uses current economic asset data to repeatedly flood the over \$1 billion in real estate assets in Stockton's most expensive neighborhood.

2. Billions of dollars in South Sacramento real estate is defined as inside the Delta 100 year flood plain, when those properties are both outside the Delta and were recently removed from the 100-year floodplain due to levee improvements.

3. High-risk flooded islands are assumed to be rebuilt just as they were originally and are repeatedly flooded in the simulations. Complete rebuilding is unlikely for behavioral and policy reasons, exaggerating the losses.

- Losses from water export disruptions are exaggerated.

⁴ For an example with a few parameters, see

<http://forecast.pacific.edu/articles/peripheral%20canal%20PPIC%20review.pdf>

⁵ http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/phase1_information.cfm

1. The analysis assumes that water managers would not employ several strategies to reduce the costs of temporary water shortages.
 2. New analysis done for the BDCP and DWR shows that the exports pumps would be disabled for a much shorter period of time than estimated in DRMS.
- Although the costs from DRMS were exaggerated, it has been made worse by frequent misuse and misinterpretation of results by others. The majority of the estimated losses are in-Delta, yet they are often portrayed as losses from water deliveries. Twenty five year cumulative losses are often portrayed as coming from a single event.

3 Suddeth, Mount and Lund (2010) Levee Decisions Study⁶

- Unlike the peripheral canal analysis by the same authors, this report evaluates levee investments with the present discounted value approach that explicitly considers the lack of benefits while costs are incurred during the building period. The framework is correct, but is notably inconsistent with the framework they used to evaluate the peripheral canal in the 2008 Comparing Futures report. Thus, they are evaluating levee investments with a much tougher framework than they used to evaluate a peripheral canal.
- Utilizes the high levee failure probabilities from the DRMS study which leads to what the recent National Academy of Sciences review of the BDCP refers to as “error propagation.”
- Utilizes very low values for Delta farmland (\$2500 per acre) that are substantially lower than current market values for Delta farmland (\$6000 per acre) that already include a significant discount for flood risk and levee costs. An argument could be made that the correct value for the analysis of rebuilding after flood would be comparably productive farmland without flood risk which sells for \$8,000 to \$12,000 per acre in the region.
- Some engineers have said the study underestimates the cost of reinforcing downwind islands when levees fail.
- Underestimates the infrastructure cost of island failures, although they do consider major transportation infrastructure and indicate western islands critical to water conveyance, this is only part of the infrastructure services.
- Does not consider possible effects on recreational activities in the Delta.
- The most recent, published version of the paper does illustrate results under some more realistic alternatives for land values and other parameters that significantly reduce the number of island that are “optimum” to leave flooded.
- The very expansive open water scenarios with twenty or more permanently flooded islands are clearly not economically optimal as the authors claim.
- We use an alternative scenario run by the authors with more realistic property and infrastructure values as the basis for our six-island open water scenario in the next part

⁶ <http://watershed.ucdavis.edu/pdf/Suddeth-Mount-et-al-2010-SFEWS.pdf>

of the report. These six islands were relatively free of major infrastructure or permanent residents, produce lower-value crops, and are therefore more realistic to consider.

4 Conclusion

All of these influential reports have serious problems, and have incorrectly influenced decision makers towards alternatives that do not support economic sustainability in the Delta. In the case of the PPIC, it is important to note that two recent developments have provided real world demonstrations of the inaccuracy of the models we criticize above. The first episode was the 2009 drought. The negative impacts of the drought, particularly on San Joaquin Valley agriculture, was wildly overestimated by UC-Davis/PPIC affiliated researchers using some of the same models used to justify the peripheral canal in the 2008 Comparing Futures study.⁷

Furthermore, when viewed in their entirety including reports not reviewed above, recent reports by the PPIC and UC-Davis researchers affiliated with the PPIC show a pattern of inconsistency in the way they assess and frame in-Delta versus out of Delta impacts. A few examples of anti-Delta include:

- Ignoring the construction time period and not using present discounted value approach when evaluating the peripheral canal, while imposing a much tougher standard that accounts for the lack of benefits during the construction period and present discounted value approach when evaluating investments in repairing breached levees.⁸
- In the Delta, they did not calculate economic impacts from lost agricultural production such as lost jobs when evaluating increased Delta salinity from isolated conveyance and they called up to \$200 million in Delta losses “notable for costs that it did not show.” However, similar studies at the same time of San Joaquin Valley agriculture described similar revenue losses as very severe economic costs, and applied huge estimates of economic impacts and job loss.
- The 2009 Water Myths report, the “No Villains” section notably leaves out in-Delta interests while casting south of Delta farmers, urban users, and environmentalists in a positive light.
- The 2009 Water Myths report labels water subsidies to Central Valley Project farmers a myth, while denouncing “large” subsidies for Delta farmers levees. The reality is that Delta farmers have historically paid much larger cost shares (50%) for levee improvements through subventions, and that these levees upgrades provide benefits to many groups other than the farmers, including water exporters. In contrast, the interest subsidies for the Central Valley Project are much larger than the levee subventions program, and provide purely private rather than statewide benefits.

⁷ There is no weblink or reference to these reports anymore, because the UC-Davis researchers have withdrawn the erroneous modeling and removed the study from their website.

⁸ See Delta Dilemmas (<http://agecon.ucdavis.edu/extension/update/issues/v10n4.pdf>) or the 2007 PPIC report, *Envisioning Futures*. If they were to treat in-Delta and south-of-Delta impacts consistently, the UC-Davis researchers would have applied their 50 jobs per \$1million agricultural employment multiplier that they were using in many studies of south of Delta agriculture at the same time. At up to \$200 million in losses, they would have said their salinity modeling showed that up to 10,000 jobs could be lost in the Delta.

- When modeling losses to urban and agricultural Delta water exporters, the PPIC uses assumptions from the high-range of available values for nearly all choices including water recycling, desalination, and population growth. In contrast, when modeling the decision of whether to rebuild Delta levees, they assume very low values of cost such as \$2500 per acre for Delta cropland and leave out several types of infrastructure costs.

Our review has found significant problems with all of the reports and that the concerns of the Delta Protection Commission were well founded. There is a critical need to strengthen the economic knowledge base supporting Delta policy decisions, and there should be a commitment to economic research in the Delta that is comparable to the commitment to ecological research.